Bryant – Algebra 2

Name: Mikey Date: ______ Hour: 5

Section 3.1 – Systems of Linear Equations

Objectives:

- Solve systems of linear equations graphically.
- Solve systems of linear equations algebraically.
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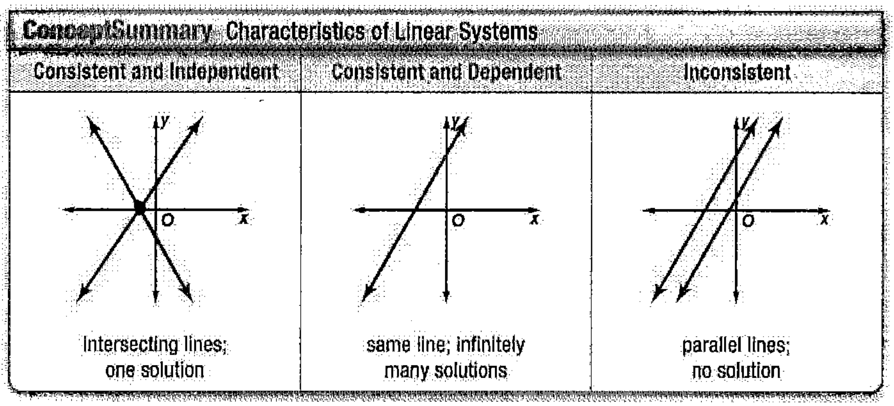
Introduction to Systems of Equations:

- A system of equations is a series of two or more equations that describe the same situation.
- There are 3 possible outcomes to solving a system of linear equations:
  - One solution: an ordered pair
  - No solution: parallel lines → never intersect
  - Infinite solutions: both equations really describe the same line

SOLVING SYSTEMS

looking for an ordered pair (x,y) that satisfies both equations.



Three Methods to Solve Systems:

will allow us to solve for a single variable.

1. Graphing (Friday, 9/19)
2. Substitution (Monday, 9/22)
3. Elimination (Tuesday, 9/23)

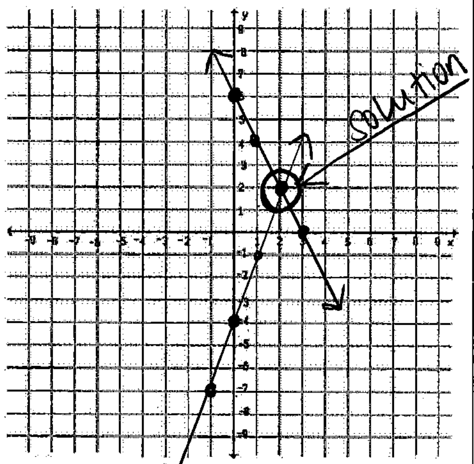
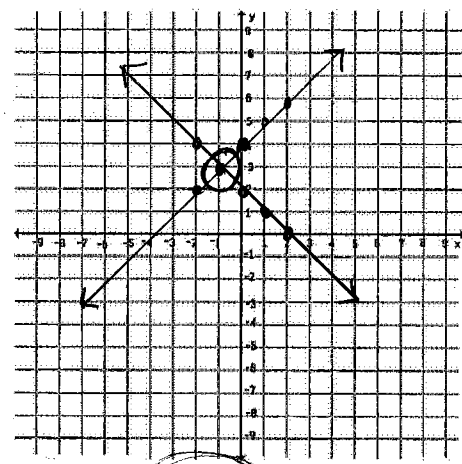
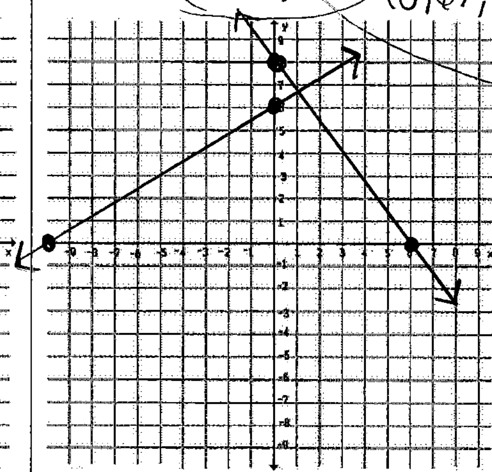
Method #1 - Graphing to Solve

- The solution to a system of linear equations will occur at the intersection of the two lines.
- Graph both lines on the same coordinate grid.
  - Either transform into slope intercept form or
  - Graph using intercepts. → $(x,0)$, $(0,y)$ → 2 points to graph
- Determine the point of intersection.

$y = -\frac{4x}{3} + \frac{24}{3} \rightarrow y = -\frac{4}{3}x + 8$

$y = \frac{3x}{5} + 6$

To put into our calculator, equations must be in y= form

Example #2	Example #3	Example #4
$y = 3x - 4$ $y = -2x + 6$	$y = x + 4 \rightarrow 3 = (-1) + 4$ ✓ $x + y = 2 \rightarrow (-1) + (3) = 2$ ✓	$4x + 3y = 24$ $(0,8)$, $(6,0)$ $-3x + 5y = 30$ $(0,6)$, $(-10,0)$ → $-3(0) + 5(y) = 30$
		
Solution: $(2,2)$	Solution: $(-1,3)$	Solution:

must be written as an ordered pair

HW: Pg. 142 #31-35 odd

Method #2 – Solving Systems with Substitution

- Substitution here means replacing one ______________ with a ______________ or an ______________.

For example:

- If y = ♥, then I can substitute that into the equation 3y + 8 = x
- So: 3♥ + 8 = x

Example #5	Example #6	Example #7
$5x - 3y = 23$ $y = -2x + 7$	$x - 7y = 11$ $5x + 4y = -23$	$-6x - y = 27$ $3x + 8y = 9$
Solution:	**Solution:**	**Solution:**

Method #3 – Solving Systems with Elimination

- Your goal is to add or SUBTRACT the two equations in order to GET RID OF a variable. → leaves us w/ only one variable.
- If necessary, you can MULTIPLY both sides of $\boxed{\text{one or both}}$ equations by a number in order to prepare the equations for ELIMINATION

WHAT WE NEED → Inverses
1. Opposite signs
2. Same coefficient (LCM)

*Adding two equations together

Example #8 Level 0	Example #9	Example #10
$4x - 3y = -22$ $+\ 2x + 3y = 16$ $6x + 0y = -6$ $6x = -6$ $x = -1$ $4(-1) - 3y = -22$ $-3y = -18$ $y = 6$	$-1 \cdot (6x - 5y = -8)$ $4x - \cancel{5y} = -12$ $+\ -6x + \cancel{5y} = 8$ $-2x = -4$ $x = 2$ $4(2) - 5y = -12$ $-5y = -20$ $y = 4$	$-2 \cdot (6x - 4y = 30)$ $12x + 5y = -18$ $30x - \cancel{20y} = 150$ $+\ 48x + \cancel{20y} = -72$ $78x = 78$ $x = 1$ $12(1) + 5y = -18$ $5y = -30$ $-12x + 8y = -60$ $+\ 12x + 5y = -18$ $13y = -78$ $y = -6$ $6x - 4(-6) = 30$ $6x = 6$
Solution: $(-1, 6)$	Solution: $(2, 4)$	Solution: $(1, -6)$

$x + \cancel{3y} = 7$
$+\ \cancel{-3y}$
$x = 7$

$\cancel{-2x} - 5y = 15$
$\cancel{+2x}$
$-5y = 15$

For elimination
- No equation has x or y alone (better for substitution)
- All equations are in standard form → You may have to do some rearranging...

Real World Problem Practice:

Solve for x ; find how many minutes

Practice: Heath is shopping for a new cell phone carrier. AT&T charges a flat fee of $75 each month then charges $0.50 per minute. Verizon is going to charge $150 for the phone but only $0.10 per minute. How long would Heath need to use his phone each month for each option to cost the same amount? How much is that cost?

AT&T = Verizon

SUBSTITUTION *COST IS THE SAME*

Step 1: Define your variables

x = minutes

y = cost

$y = .50x + 75$ — (0.50/minute), fee

$y = 150 + .10x$ — fee, (0.10/minute)

$.50x + 75 = 150 + .10x$

SOLVE FROM HERE

Step 2: Write two equations to represent this situation.

1. Lancaster Woodworkers Furniture Store builds two types of wooden outdoor chairs. A rocking chair sells for $265 and an Adirondack chair with footstool sells for $320. The books show that last month, the business earned $13,930 for the 48 outdoor chairs sold. How many of each chair were sold?

R = rocking chairs

A = Adirondack chairs

$\boxed{R + A = 48}$ ← 1 equation relates to quantity

$R = 48 - A$

$265R + 320A = 13{,}930$ ← Total price

$265(48 - A) + 320A = 13{,}930$

A = ______

system to solve in order to find how many of each chair was sold.

*Answer will not be an ordered pair.

Sentence: ______ Rocking chairs & ______ Adirondack chairs were sold.

2. At Amy's Amusement Park, tickets sell for $24.50 for adults and $16.50 for children. On Sunday, the amusement park made $6405 from selling 330 tickets. How many of each kind of ticket was sold?

total qty.

total sales

A = # of adult tickets

C = # of children's tickets

$a + c = 330$

$24.50a + 16.50c = 6405$

NEW

Solve by substitution or elimination

$a = 330 - c$

$24.50(330 - c) + 16.50c = 6405$

c = ______

3. Levi has a job offer in which he will receive $800 per month plus a commission of 2% of the total price of the cars he sells. At his current job he receives $1200 per month plus a commission of 1.5% of his total sales. How much must he sell per month to make the new job a better deal?

NEW > OLD

S = sales
E = earnings

New: $E = 800 + 0.02s$

Old: $E = 1200 + 0.015s$

$800 + 0.02s > 1200 + 0.015s$

4. A youth group went on a trip to an amusement park, travelling in two vans. In the first van, there were 2 adults and 5 children and it cost a total of $77 to enter the park. In the second van, there were 2 adults and 7 children and it cost $95. Find the adult price and the student price ~~of admission.~~

A = price for adult tickets
S = price for ~~student~~ tickets

$-1 \cdot (2A + 5S = 77)$

$2A + 7S = 95$

$+ -2A + -5S = -77$

$2S = 18$

S = 9

A =

Answer is a sentence

5. To raise money for new uniforms, the band boosters sell T-shirts and hats. The cost and sale price of each item is shown in the table below. The boosters spent a total of $2000 on hats and T-shirts and they made $3375.

How many T-shirts did they sell?

Item	Cost	Sale Price
T-Shirt	$6	$10
Hat	$4	$7

① T = # of t-shirts
H = # of hats

② $6T + 4H = 2000$
$10T + 7H = 3375$

Special Cases:
